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Today's Topic:

Unlocking Braking Knowledge: MCI ABS Systems

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Agenda

During this presentation, you will received instruction about:

- System Overview
  - Features & Benefits of ABS & ATC
- Identification & Explanation of ABS & ATC components
  - ECU, wheel speed sensors & tooth wheels, modulators
  - Dash mounted controls & indicators
- Diagnostics of ABS & ATC components & systems
  - Blink codes
  - Diagnostic tools
    - Pro-Link 9000
    - TOOLBOX® PC Diagnostic
    - Bendix ACom®
- Recommendations for component replacement

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Safety Message

- Always use personal protection devices
  - Safety glasses, ear protection, etc

- Always observe all safety precautions listed in the Mai l including but not limited to:
  - Ensure coach is on a level surface
  - Ensure Parking Brake is applied
  - Chock Wheels
  - Always use jack stands
  - Shut off Batteries
  - Utilize Lock Out/Tag Out procedures

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Features & Benefits of ABS & ATC

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ABS Mandates

Federal Motor Vehicle Safety Standards 121 (FMVSS 121) details the Federal mandates for heavy duty vehicle ABS systems

- March 1, 1997: ABS required on all new tractors w/GVWR >10,000lbs
- March 1, 1998: ABS required on all new trailers, single-unit trucks and buses w/GVWR >10,000lbs
- March 1 1999: ABS required on all hydraulically braked vehicles w/GVWR >10,000lbs

- Minimum system requirements: 4S/4M (Four (4) sensors, four (4) modulators)

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Features and Benefits of ABS

- ABS modulates the air pressure in the brake chamber to prevent wheel lock-up and provide braking control during over-braking
- ABS enhances:
  - Vehicle stability
  - Steer-ability under emergency braking
  - Stable stopping on slippery roads and in curves
  - Stopping distances
- ABS reduces the likelihood of:
  - Vehicle plow-out; front wheels sliding while turned to one direction or another
  - Tire flat-spotting

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Features and Benefits of ATC

- ATC is an option available in combination with ABS
- ATC automatically applies individual Wheel Brakes or reduces Engine torque via SAE J1939 data link
- ATC improves traction, acceleration and vehicle stability
- ATC uses the same components as the ABS plus one additional Solenoid Valve
- ATC provides a Wheel Spin Indicator Light and a deep mud and snow Switch for off-road

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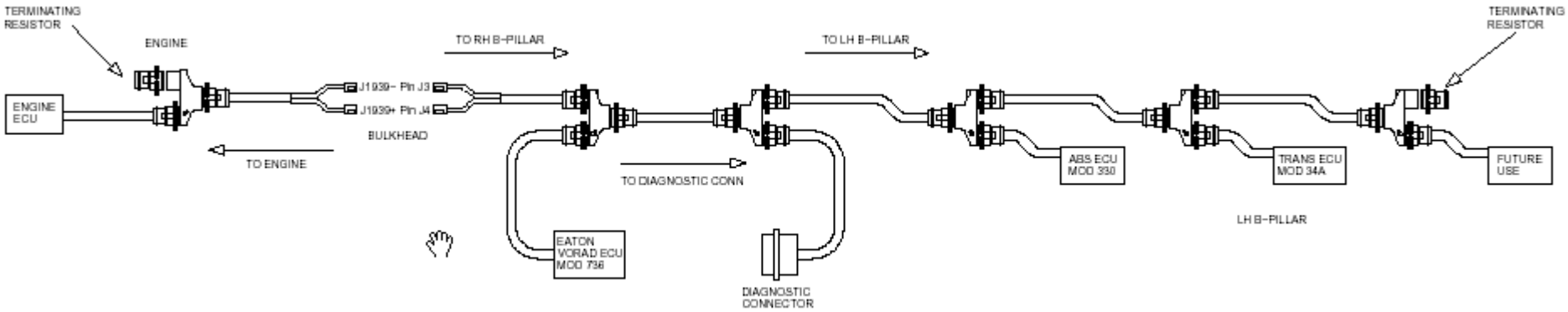
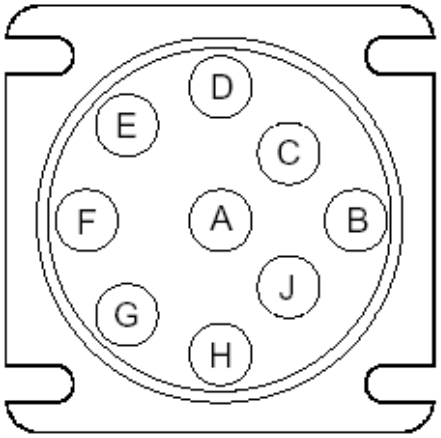
J 1939 Data Link Function Prior to 2007 Engine Technology

- Decelerates engine during ATC event (wheel spin)
- Cuts out retarder during ABS event (wheel lock)



EXAMPLE J1939 WIRING DIAGRAM



J1939 Diagnostic Connector Pinouts	
Pin	**Description**
A	Ground
B	Battery +12V
C	J1939+
D	J1939-
E	J1939 Shield (only if heavy cable is used)
F	J1587+
G	J1587-
H	Not used
J	Not used

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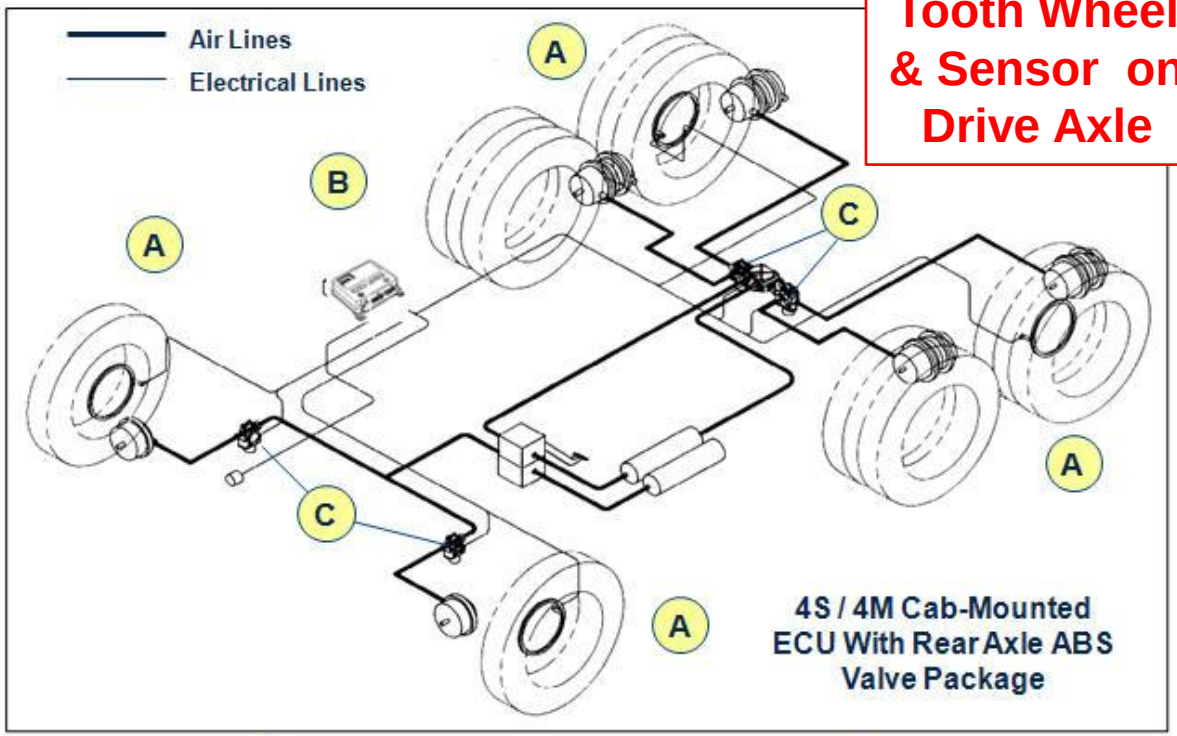
4S/4M ABS System Configuration

Tooth Wheel & Sensor on Drive Axle



A Sensors send wheel speed information to the ECU

B The ECU processes the information, determines when the wheel deceleration rate will cause lock-up and sends control signals to the ABS modulator valves

C The ABS modulator valves modulate the air going to the brake chambers for maximum braking without wheel lock

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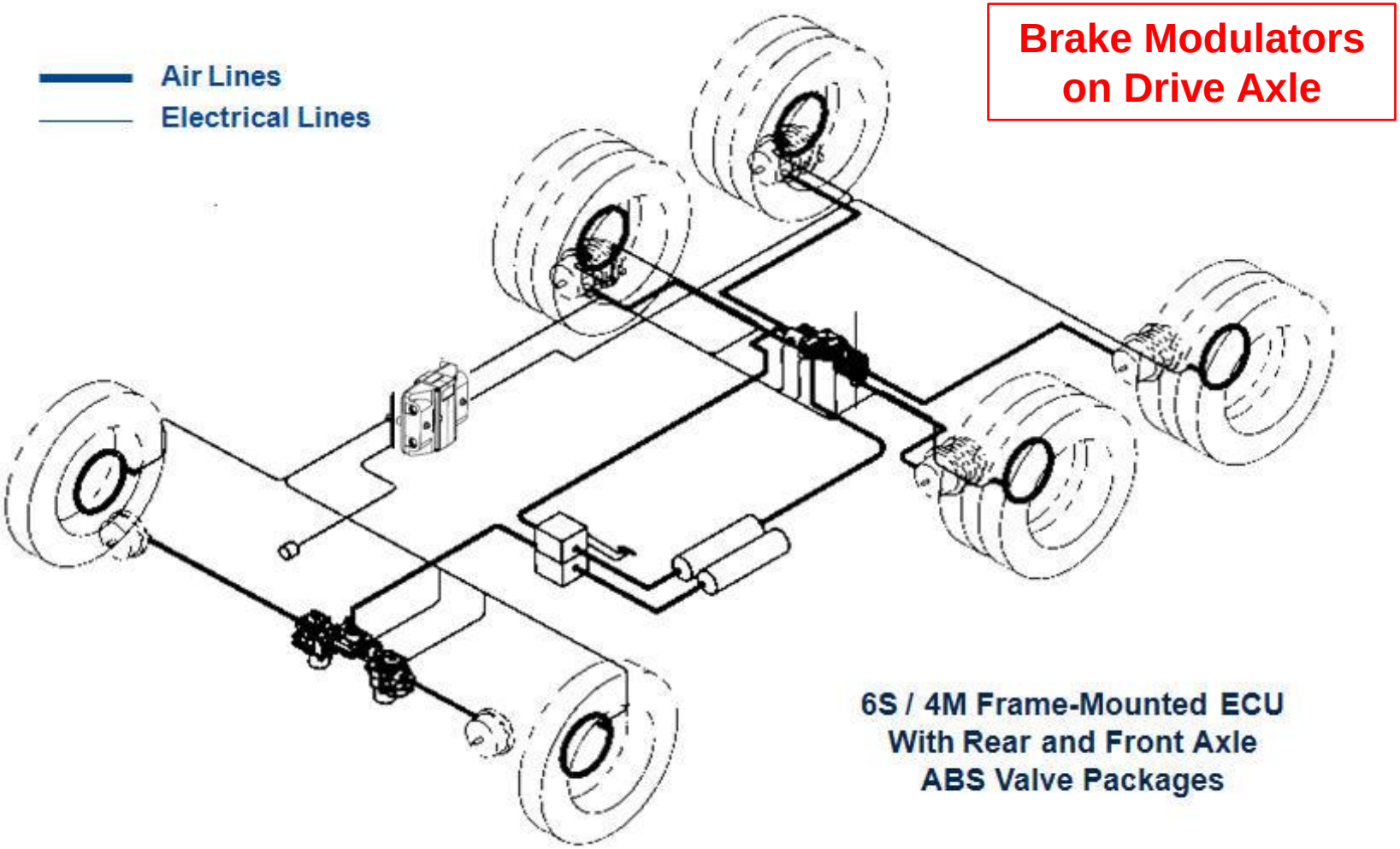
6S/4M ABS with ATC Frame Mount ECU



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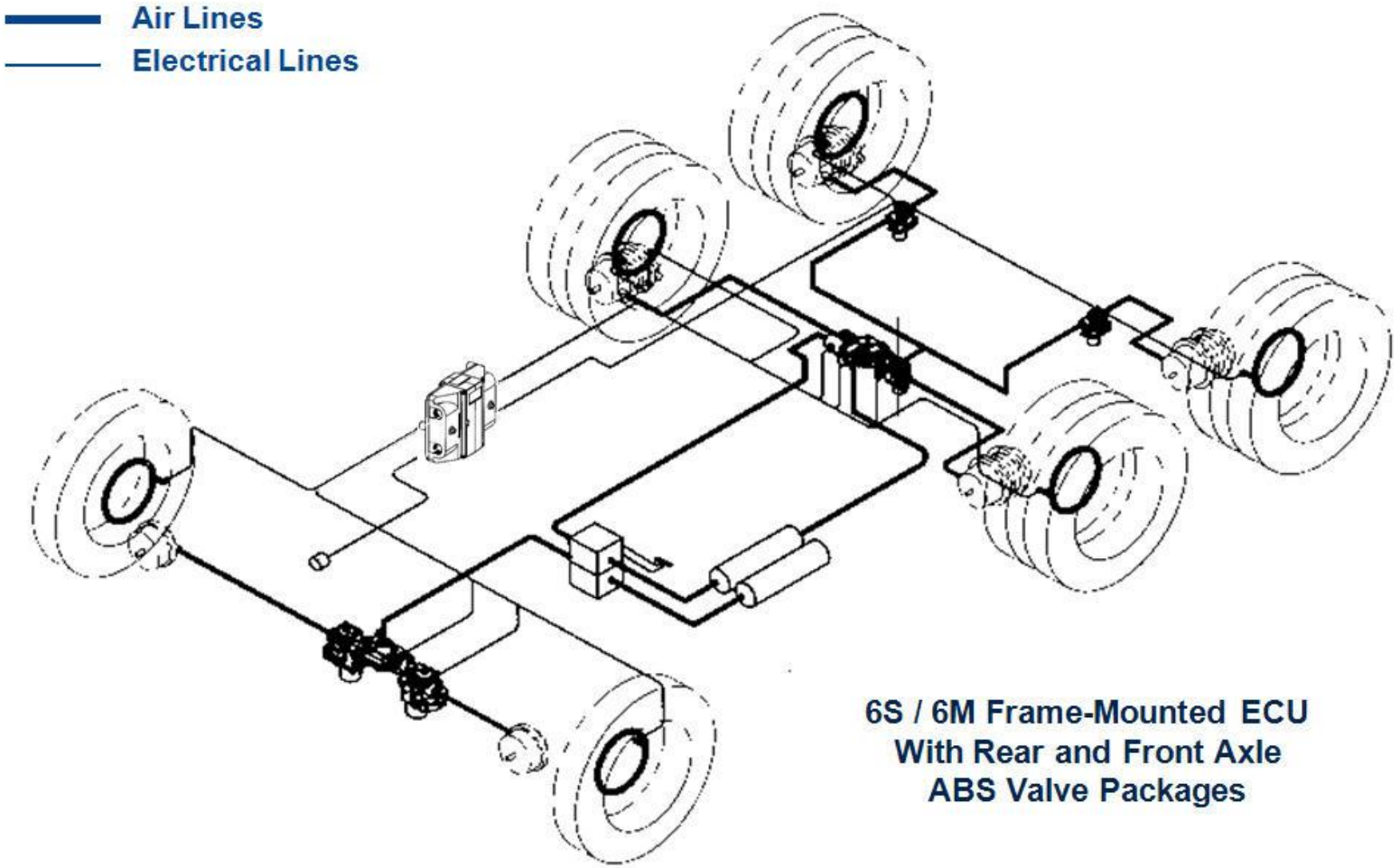
6S/6M ABS with ATC Frame Mounted ECU



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Identification & Operation of ABS & ATC Components

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ABS Components

- Wheel Speed Sensing equipment
- Electronic Control Unit (ECU)
- Brake Pressure Modulator Valves
- Electric Harnesses, Switches, Relays and Lamps

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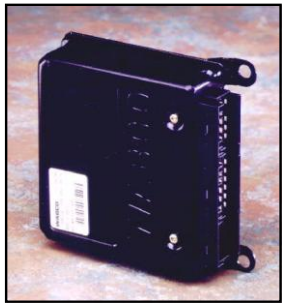
ABS ECUs (Electronic Control Unit) - Meritor

- Cab and frame-mounted ECU's available
- Available with 4S/4M through 6S/6M
- Single Wheel Shutdown in case of faults
- Automatically adjusts for Tire size difference up to 14%
- Simple, easy to use blink code diagnostics
- MPSI Pro-Link 9000 and TOOLBOXTM PC diagnostics capability
- J1587/J1939 high-speed Data Link
- Interfaces with all retarders

Basic
Cab-Mount ECU
(ATC Optional)



Frame-Mount
ECU
(ATC Optional)

Universal
Cab-Mount
ECU

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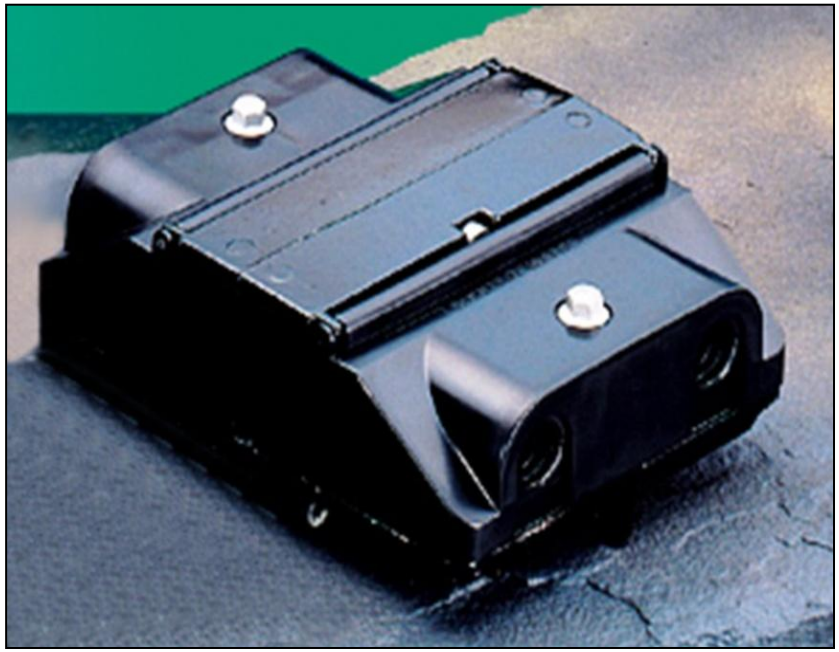
E-Version Frame Mount ECU - Meritor

- Provides installation flexibility for vehicles with limited cab space or chassis only application
- Weather-tight enclosure design for outstanding protection against the elements
- Exclusive Connector concept with built-in strain relief for highest possible Wiring and Connector reliability
- Optional ATC available
- Complete range of 4S & 6S Sensor configurations available
- Full SAE J1587 diagnostic capability current production ECU are all J1939 compliant



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E-Universal Cab-Mount ECU

- Full ABS performance
- J1939 high-speed Data Link
- Available as a 6S/4M and 6S/6M
- Full SAE J1587 diagnostic capability

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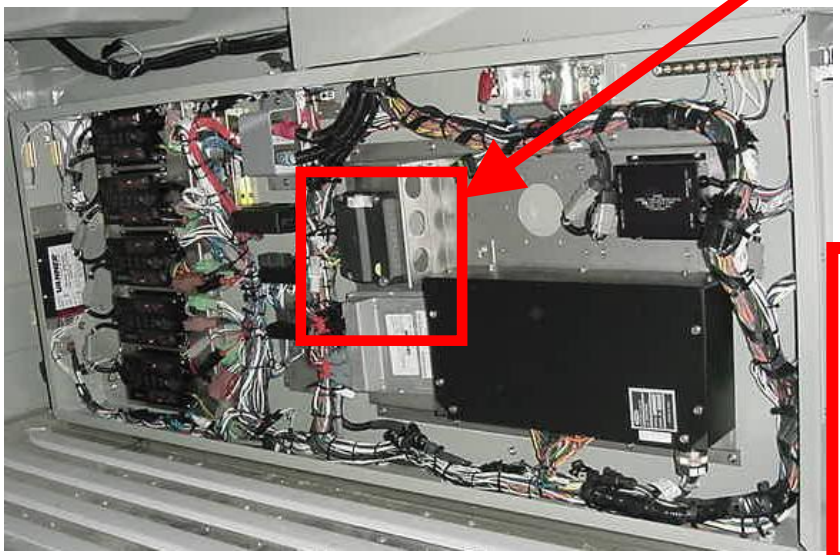
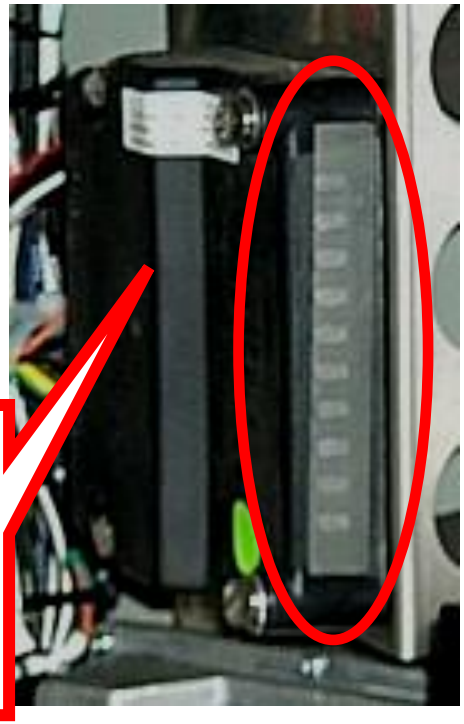
Bendix ABS ECUs: EC-16, EC-17, EC-30

- Used on early ABS equipped coaches, 4S/4M versions only
- Located in the Rear Junction Box of early MUX D Models
- Used visual diagnostics as well as basic flash codes via Diagnostic Lamp
- Diagnostic Switch & Lamp located on the curbside of the Rear Junction Box





Fault Diagnostic LEDs and ECU Reset Area

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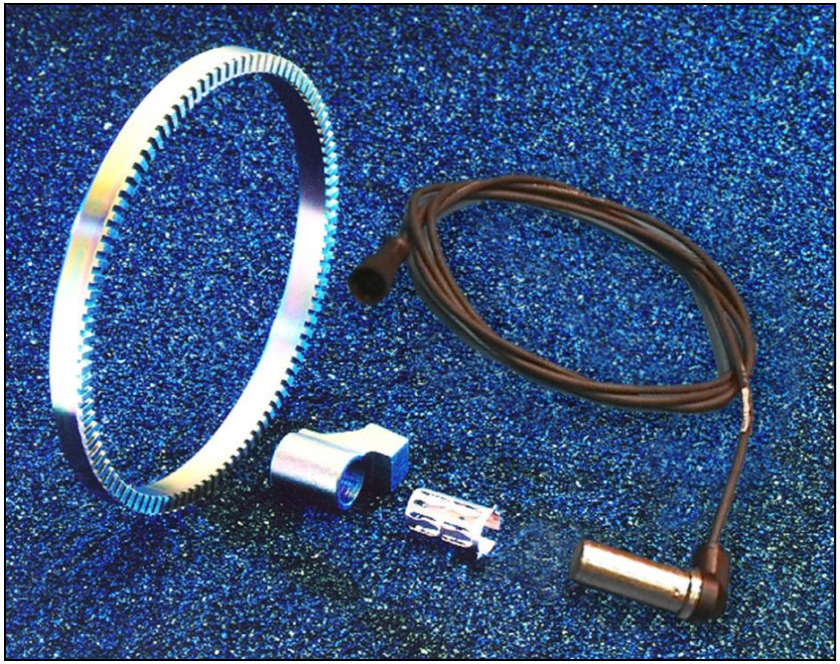
ABS Wheel Speed Sensor and Tooth Wheel

- Stamped or machined Tooth Wheel
- Fourth generation of Sensor currently in production
- Stainless steel Sensor housing
- Sensor head completely over-molded and sealed
- Over-molded Connector
- Delivers wheel speed information to ECU
- Self-adjusting air gap due to Blamping Bushing design



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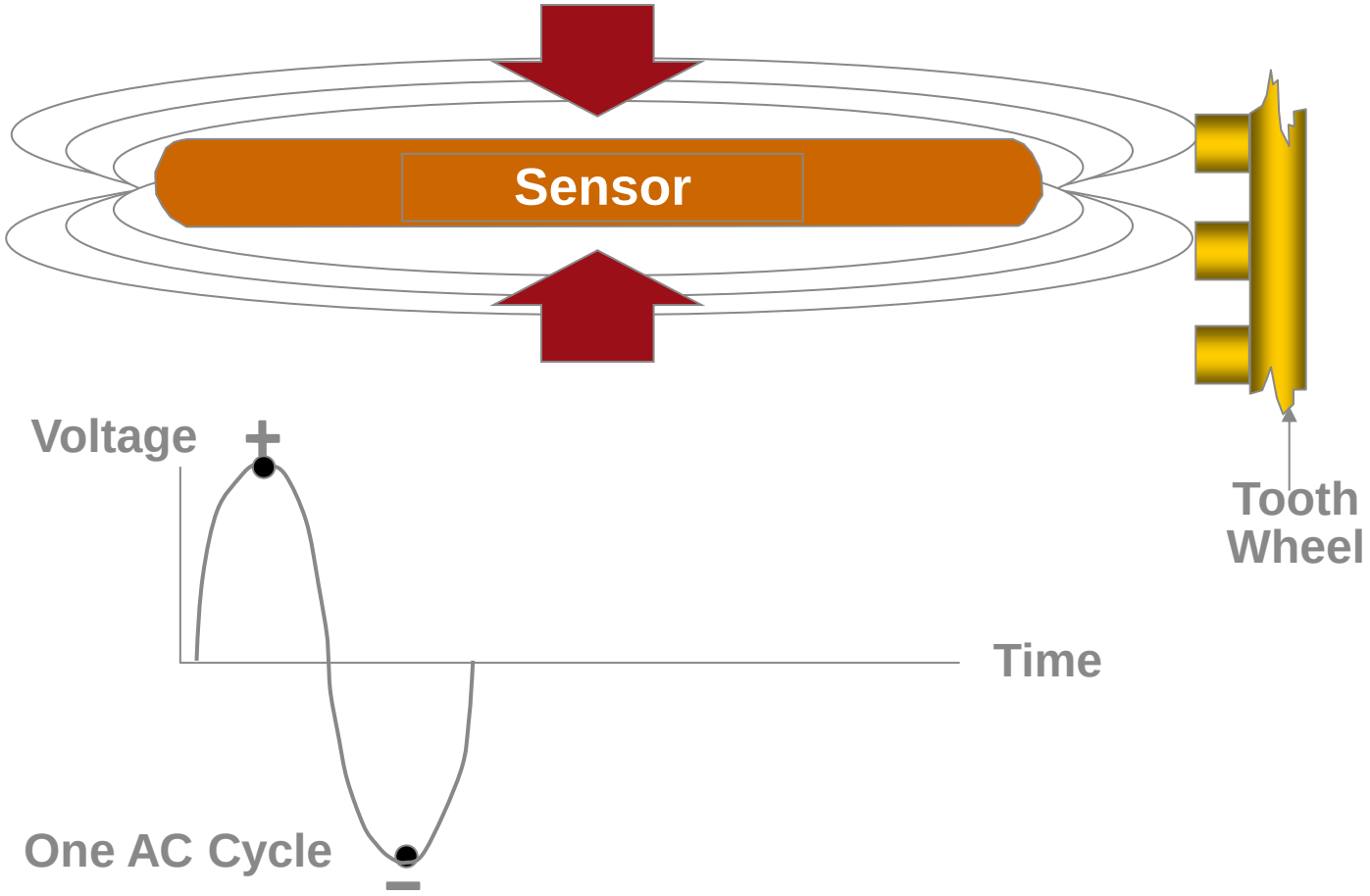
Sensor & Tooth Wheel Operation



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Dash Mounted Controls & Indicators

- Diagnostic ‘ABS Code’ Switch for basic diagnostics and fault code retrieval from ECU
- ABS lamp will flash out fault codes
- ATC ‘Mud / Snow’ Switch is used to modify the control algorithm that controls ‘wheel slip’ and ‘differential braking

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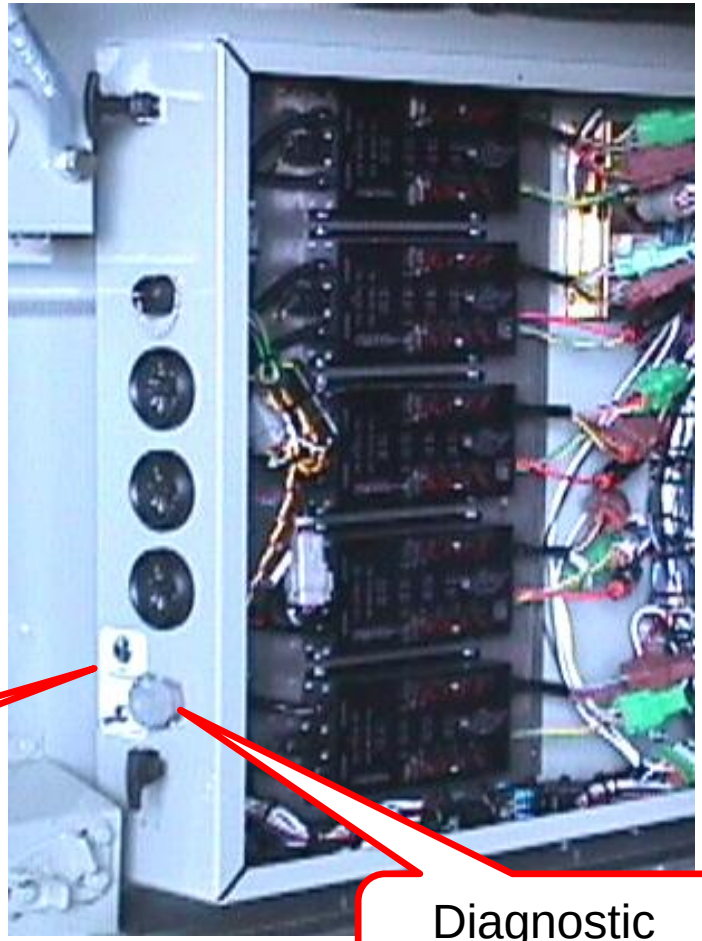
D Model Coaches, Rear Junction Box, Bay #3

- Alternative ABS Diagnostic Switch and Lamp located on curb-side of Rear Junction Box
- Pre-MUX coaches, Switch and Lamp located on Center Tunnel ceiling, road-side of coach



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ATC Valve - Automatic Traction Control Valve

- In case of an ATC event, supplies full pressure to the ABS Modulator Valves
- Mounted in control line from foot Brake Valve to Relay Valve through N/O ports
- Three pneumatic connections:
- Control pressure from foot Brake Valve
- Supply pressure from Primary Air Reservoir
- Delivery to Relay Valve control port
- One electrical connector
- Also available in ABS / ATC Rear Axle Valve package

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Wabco ABS Modulator Valve

- Used for both Steer Axle and Drive Axles
- Is mounted between the Relay / Quick Release Valve and the Brake Chamber
- Two diaphragm design
- Controls the air pressure in the Brake Service Chamber during ABS control event (supply, hold, release)

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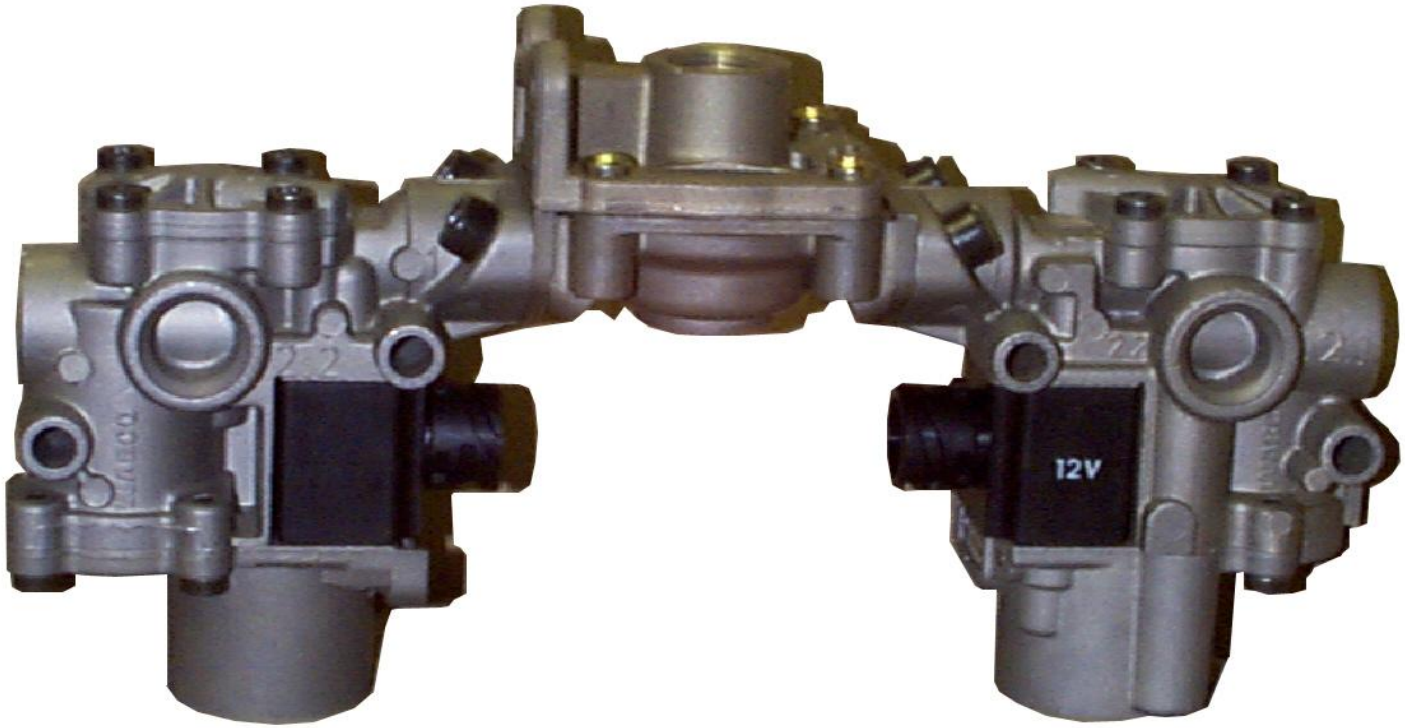
Wabco ABS Front Axle Valve Package

- Valve assembly contains two (2) Modulators and a Quick Release Valve in one assembly



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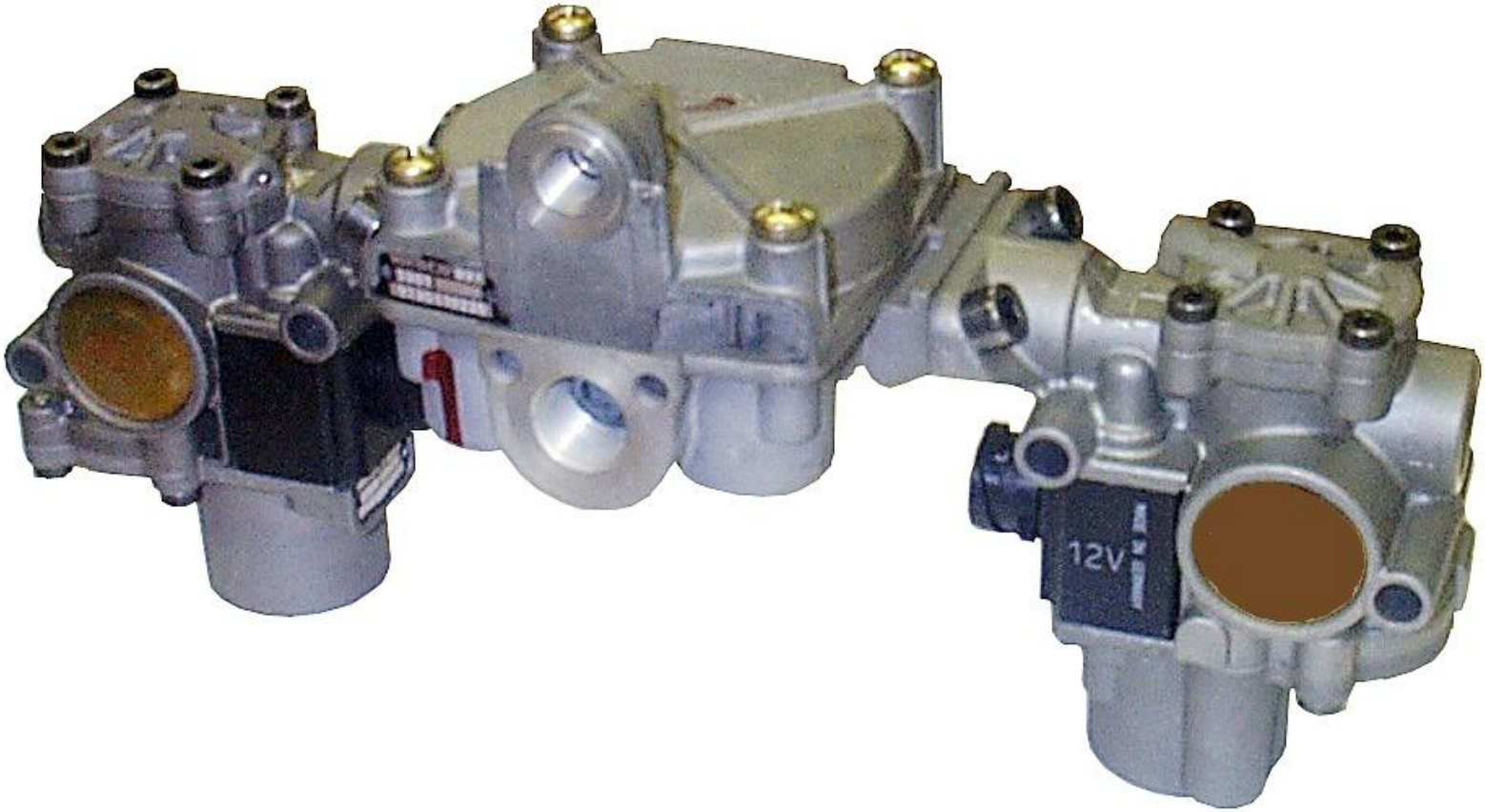
Wabco ABS Rear Axle Valve Package Without ATC



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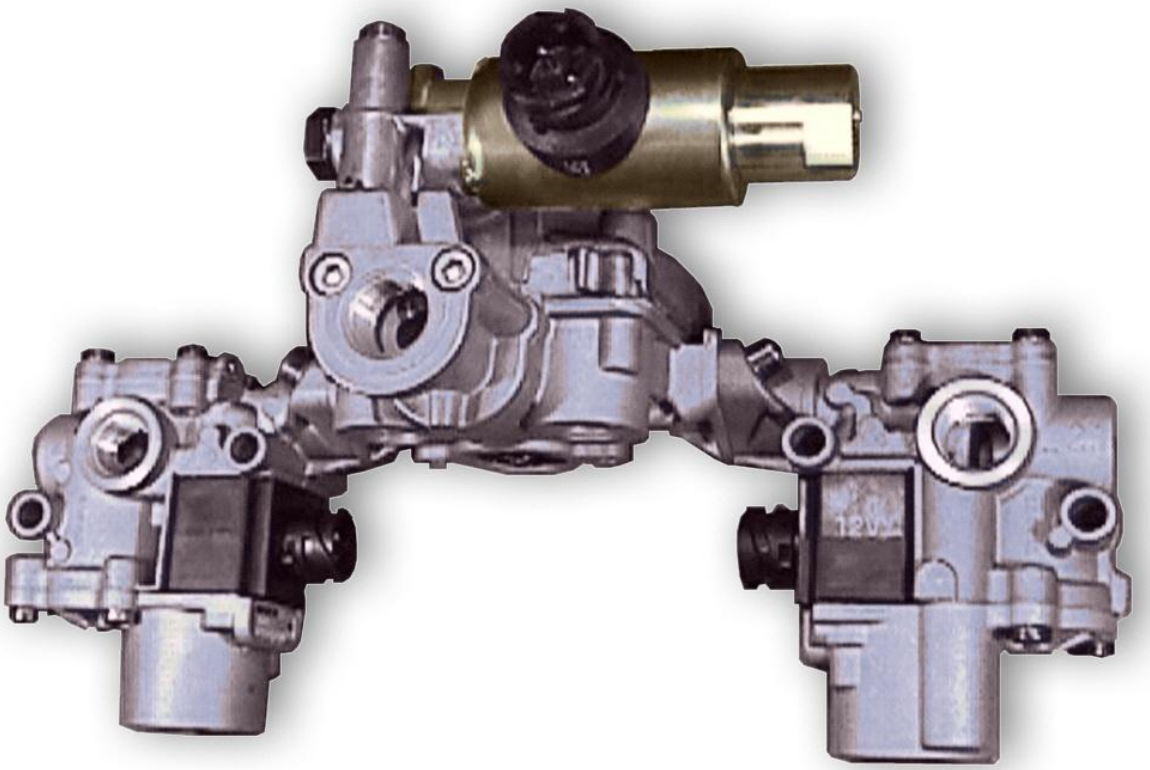
Wabco ABS / ATC Rear Axle Valve Package

- Modified Relay Valve/Modulator Valve(s) assembly with an integral ATC Solenoid Valve



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Diagnostics of ABS & ATC Components

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ABS Diagnostics Basics

- Designed to operate for the life of the coach
- Continuously self-diagnosing
- Illuminates Dash mounted Warning Light in case of a failure
- Automatically shuts off faulty system component, maybe one Wheel End or all Wheel Ends
- If ABS is shut off at one Wheel End, this wheel retains normal braking capability
- If the ABS system is shut off, the vehicle reverts to normal Air Brake operation

No Routine Periodic Maintenance Required!

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ABS Diagnostic Basics - Blink Codes

- Easy to use
- Diagnostic controls located in a clean, safe environment
- Easily accessible
- Pinpoints component or sub-system failures detected in ABS system
- No tools required
- Intermittent failures stored in memory. Faults retained even if vehicle Batteries fail or are disconnected!

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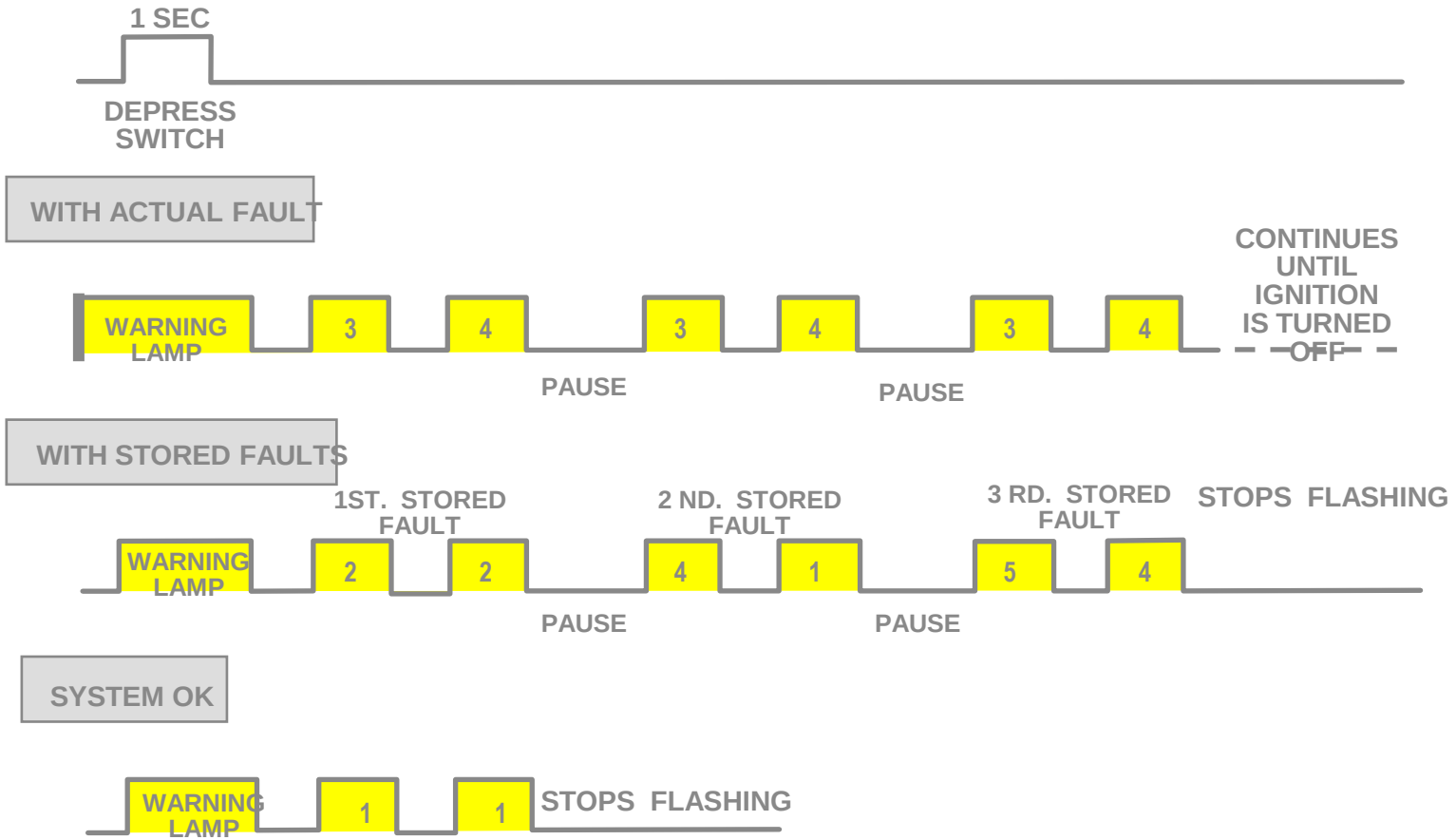
Wabco E-Version ABS Blink Codes

- Reading Fault Codes



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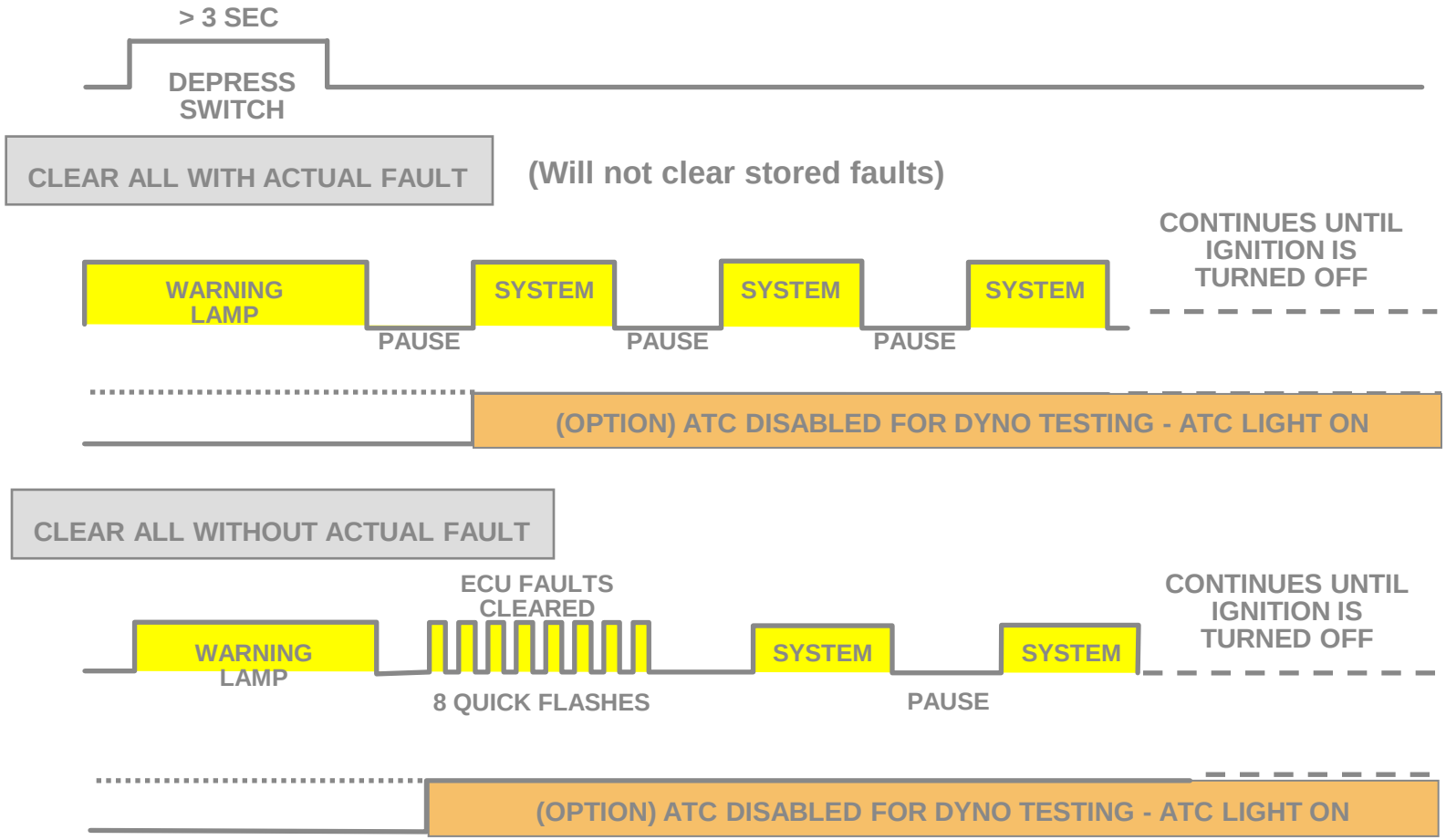
Wabco E-Version ABS Blink Codes

- Erasing Stored Fault Codes



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E-Version ABS Blink Codes

- Simplified 2 Digit Blink Code

1ST DIGIT – FAULT TYPE	2ND DIGIT – FAULT LOCATION
1. No faults	1. No faults
2. ABS modulator valve 3. Too much sensor gap 4. Sensor short / open 5. Sensor signal erratic 6. Tooth wheel	1. Right steer axle 2. Left steer axle 3. Right rear axle 4. Left rear axle 5. Right third axle 6. Left third axle
7. System function	1. J1922 / J1939 data link 2. ATC valve 3. Retarder relay 4. ABS warning lamp 5. ATC configuration 6. Trailer brake valve (RSC)
8. ECU	1. Power supply low 2. Power supply high 3. Internal fault 4. Configuration error 5. Ground 6. Accelerometer (RSC)

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Now…..From the Driver's Seat

- Locate the ABS T/T Light on the Dash.
  Easiest to do during dash self test when ignition is turned on
  1. Turn on Ignition / Master Run Switch
  2. Verify ABS T/T momentarily illuminates
     (Note: If Light stays illuminated it may have codes or it may need to be driven to clear the existing codes)

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From the Driver's Seat (Cont'd)

3. Press the ABS Code Switch briefly
   - Do not press it for longer than 10 seconds, or stored codes may be erased
4. The ABS T/T Light will begin flashing out a 2 digit code
   - There is a 1.5 sec pause between the 1st & 2nd digit
   - There is a 4 sec. pause between codes

- Note: Code 11 = System OK

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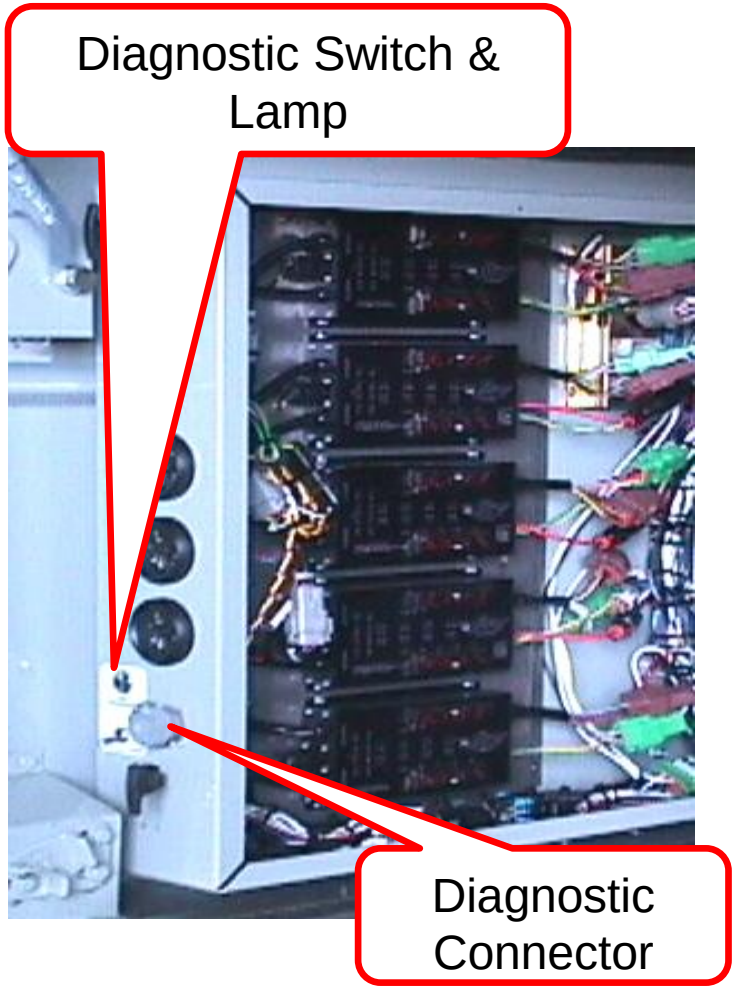
D Model Coaches, Rear Junction Box, Bay #3

- Alternative ABS Diagnostic Switch and Lamp located on curb-side of Rear Junction Box for MUX coaches
- 40’ & 45’ pre-Mux D Models also have Diagnostic Switches and Lamps located on the curbside Junction Box inside the #3 Baggage Bay



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ABS Diagnostics with Pro-Link tool

- Industry-wide accepted tools - MPSI Pro-Link 9000 with multiple protocol cartridge (MPC) and Meritor WABCO applications card
- Inexpensive
- Familiar format
- Rugged construction
- Allows component activation for testing
- Easy to update

SAE J1587 Diagnostic Data Link

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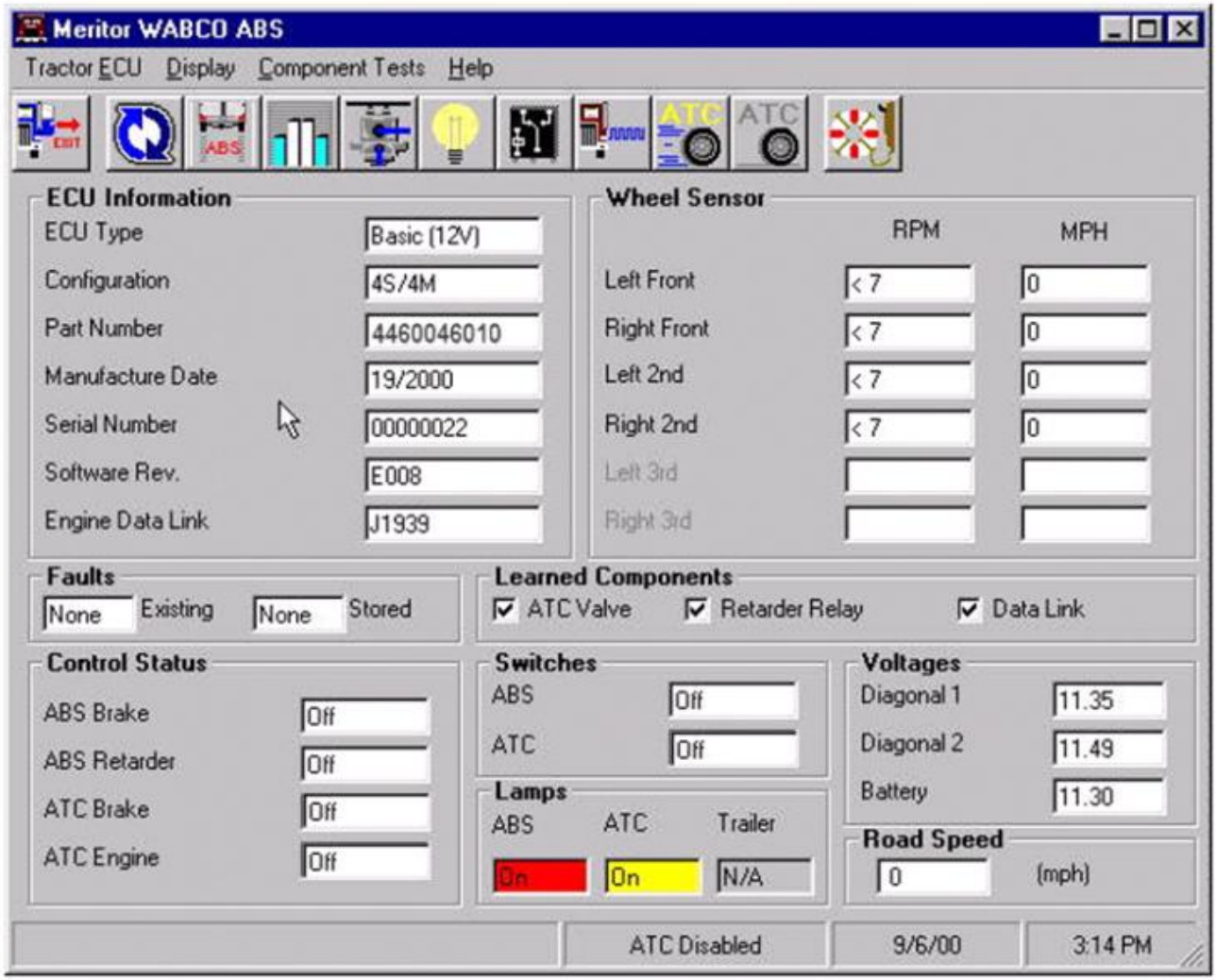
Wabco TOOLBOX™ PC Diagnostics



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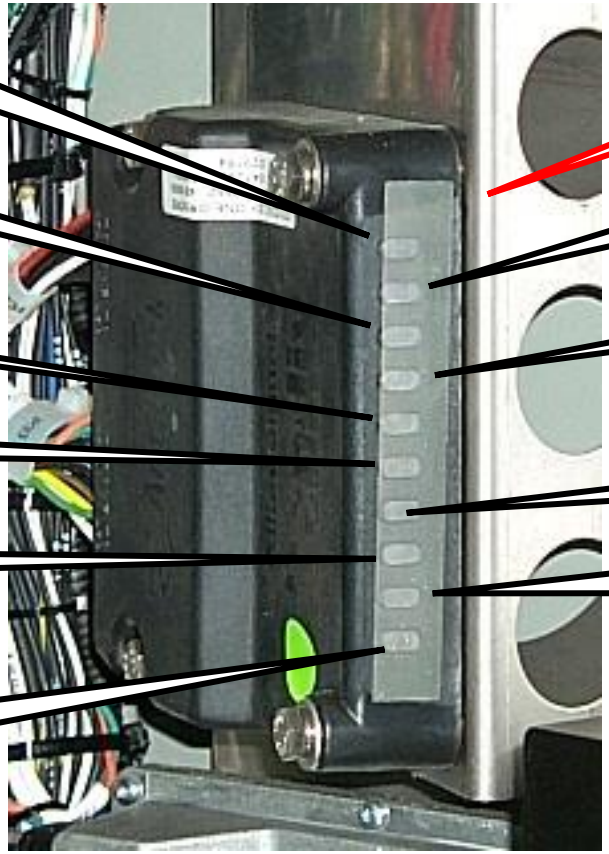
Bendix ABS ECU Diagnostic LEDs



FRT-Front-Red LED

RER-Rear-Red LED

LFT-Left-Red LED

TRC-Traction-Red LED

SEN-Sensor-Red LED

VLT-Input Voltage-Green LED

Reset Area

MID- Middle- Red LED

RHT-Right- Red LED

MOD-Modulator-Red LED

ECU-Electronic Control Unit-Red LED

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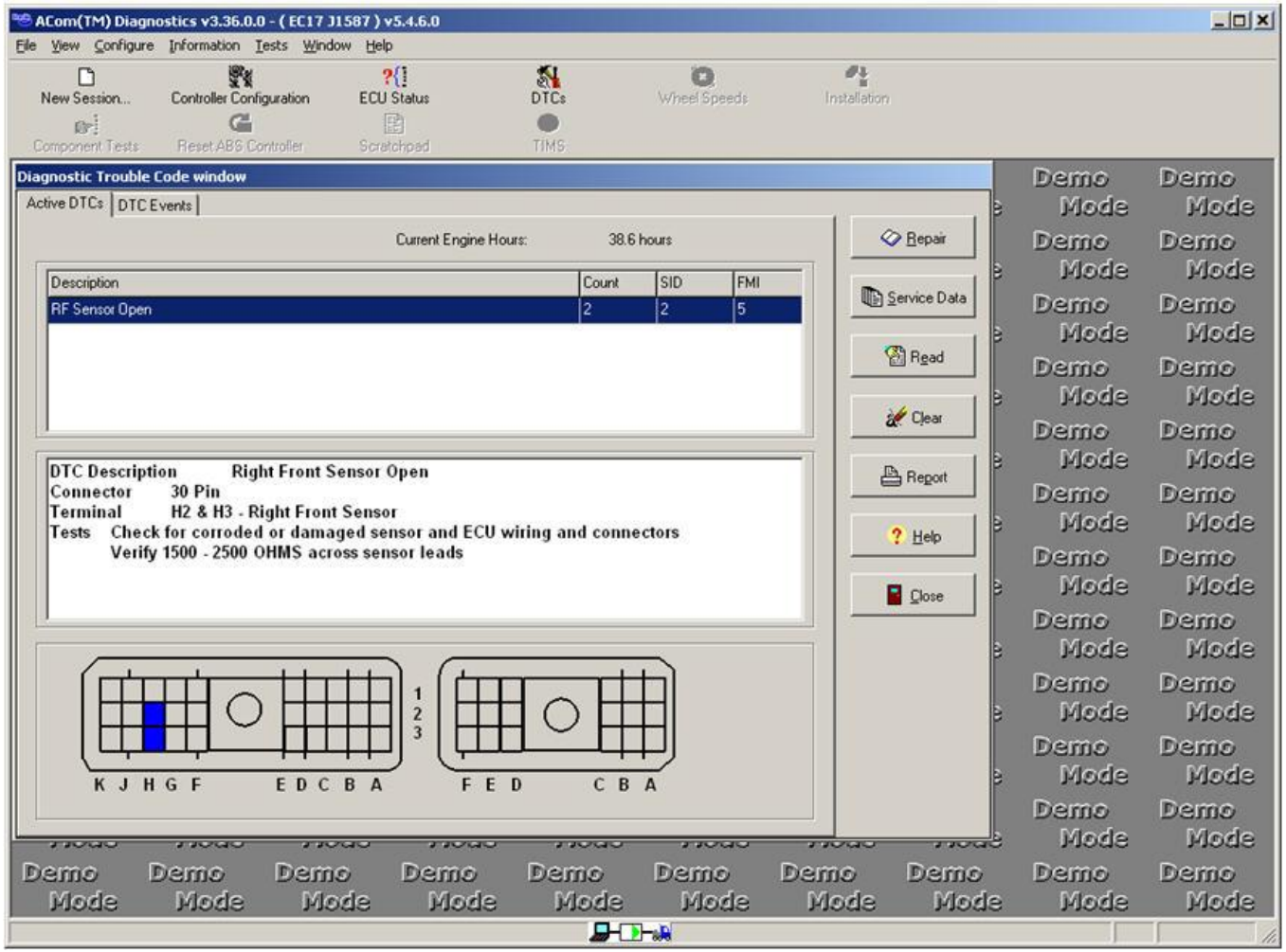
Bendix ACom® Diagnostic Software



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Recommended Good Practices for Component Service & Replacement

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Sensor Installation Recommendations

- Sensor installation
  - Use grease for the Clamping Bushing
  - Install the Sensor with grease and push it in by hand
  - Do not strike Sensor
  - Avoid stress on Cables and Connectors
  - The Cables should be routed with some slack to allow movement for Suspension and Steering
- Test Sensor after installation before final assembly

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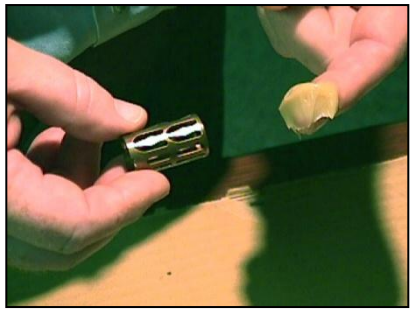
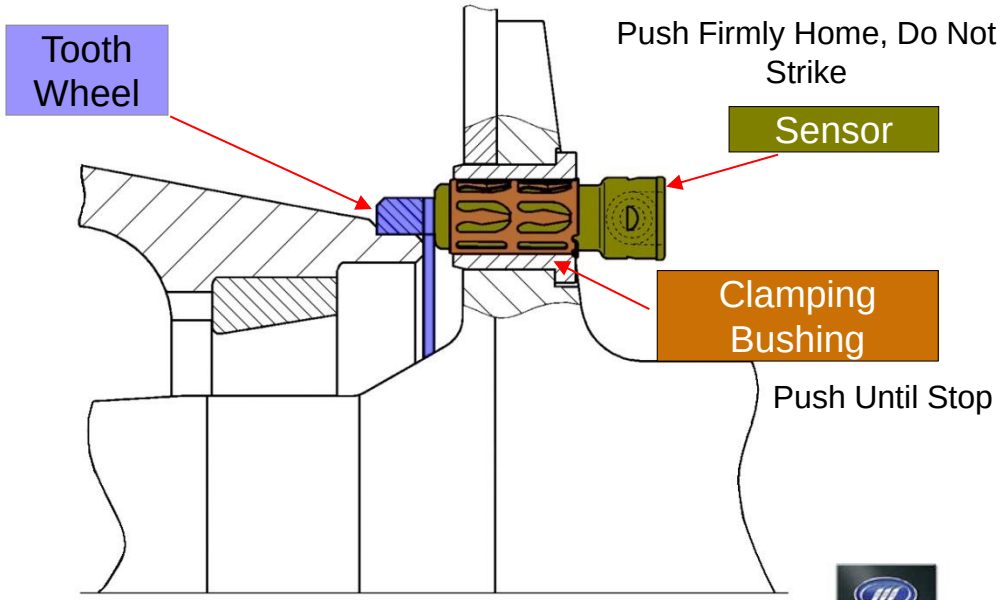
Use OEM / Vendor Approved Greases

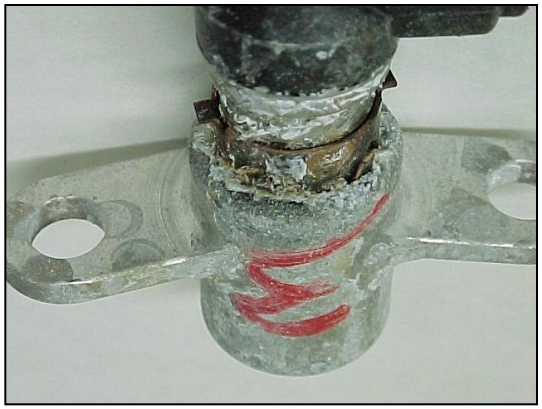
- Mobilith SHC-220 (Mobil)
- TEK-662 (Roy Dean Products)
- Staburags NBU 30 PTM (Klüber Lubrication)
- Valvoline Moly-Fortified Multi-Purpose Grease / Ford

Do This:





To Avoid This:



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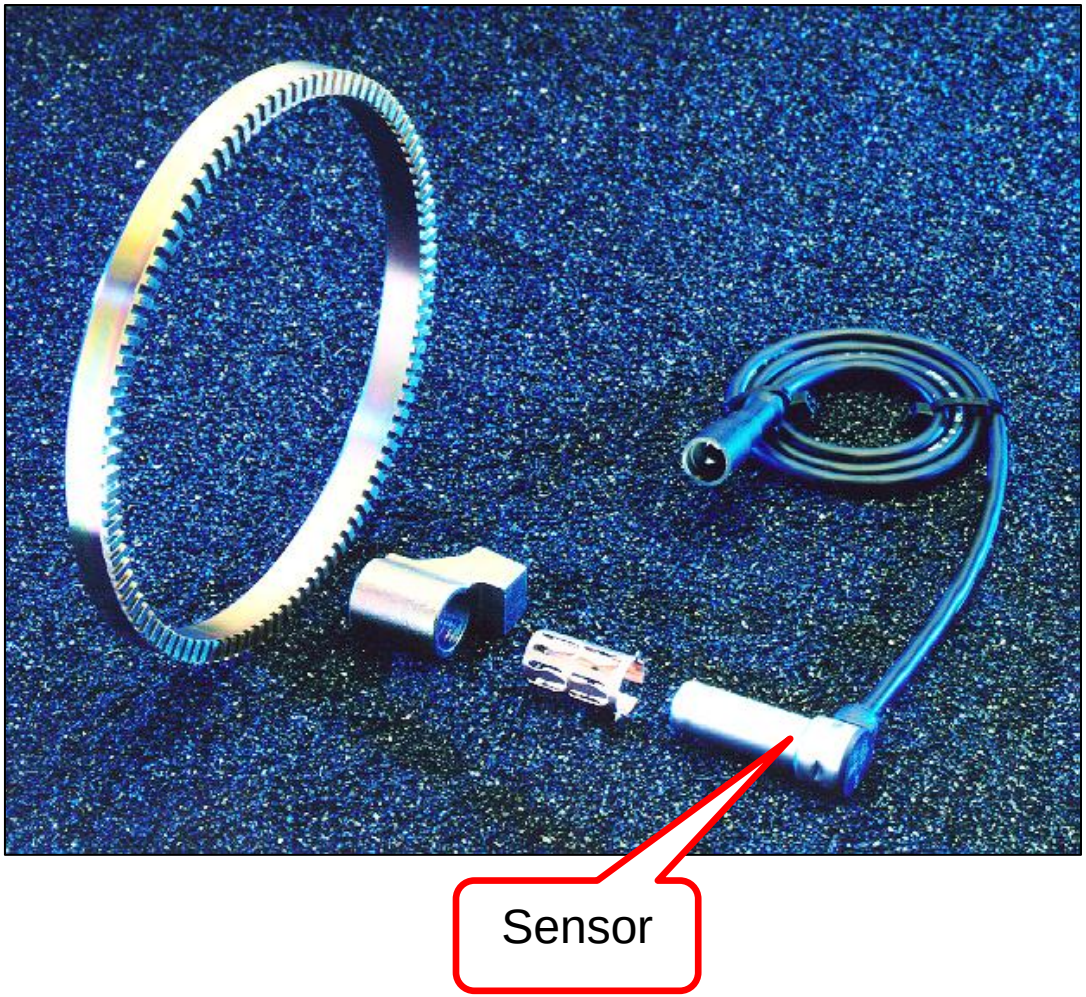
Most Common Wheel Speed Sensor Faults

- Improper air gap
- Sensor Cable break or short circuit
- Loose connections
- Spread Connectors
- Pinching or cutting the Sensor Cable with tie wraps
- Sensor Head short



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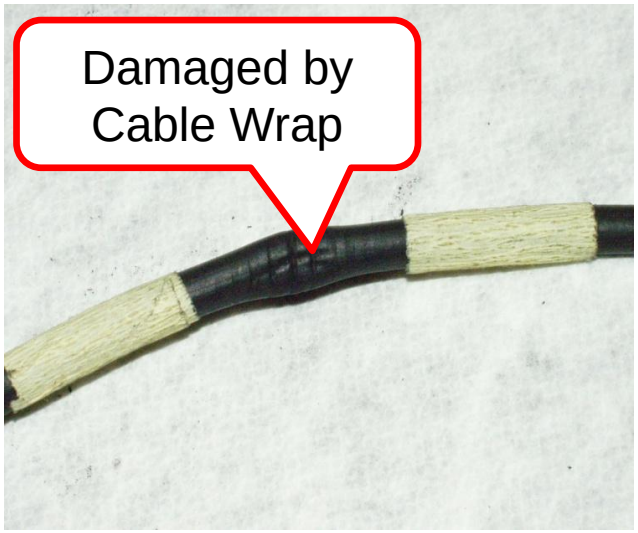
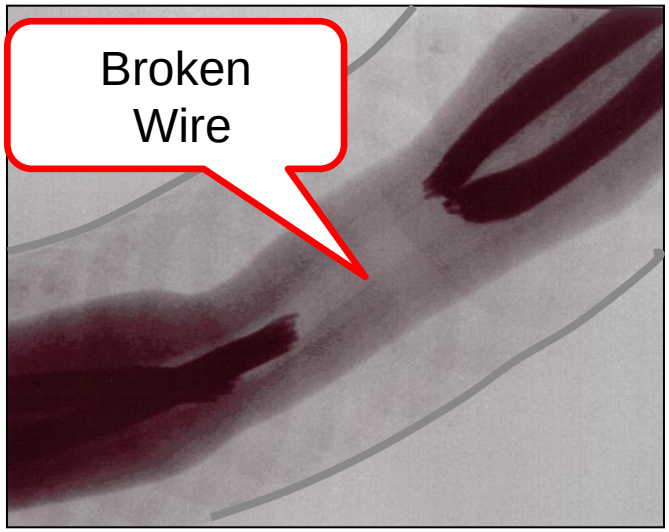
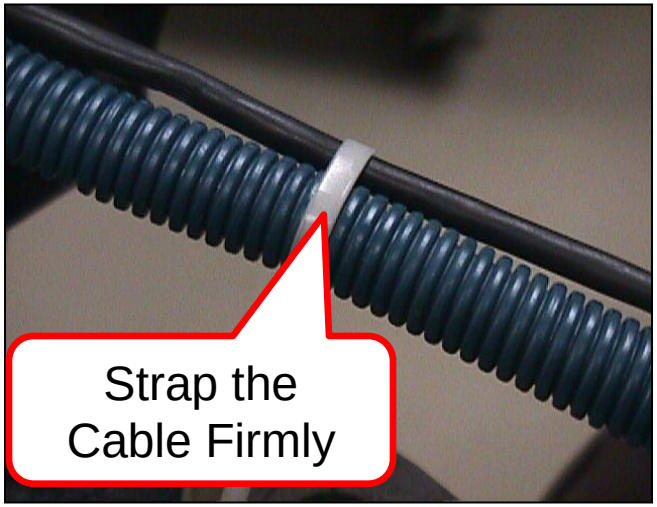
Examples of Sensor Lead Damage



NOTE:
Use black tie wraps. White tie wraps are not UV protected





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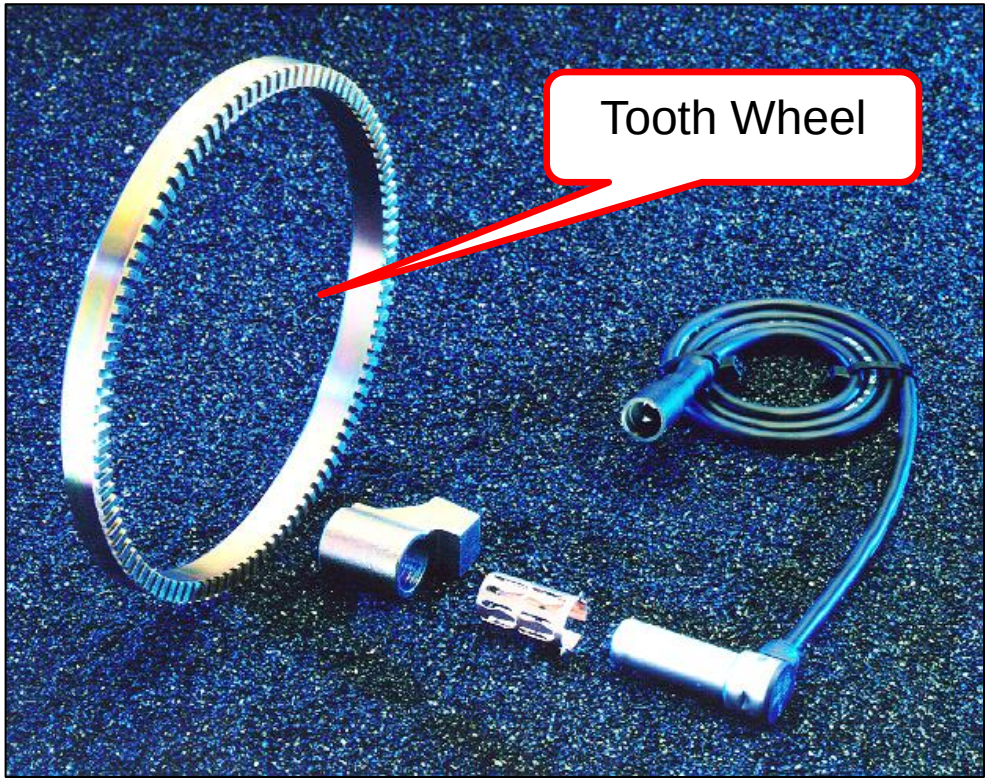
Most Common Tooth Wheel Faults

- Missing teeth in Wheel
- Debris or dirt in teeth
- Corrosion or wear of teeth
- Incorrect number of teeth on replacement Tooth Wheel
- Misaligned or loose Wheels
- Broken or missing retaining screws
- Loose Hub Bearing or bad Hubs Seals
- Wrong Tire size, severely mismatched Tires



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Installation Recommendations

- Modulator Valve installation
  - Tighten mounting bolts according to specification
  - Connect Air Line to port 1 for supply pressure and port 2 for delivery pressure
  - Hand tighten the Electrical Connector
  - Test Valve after installation
- Air Lines & Tubing
  - Avoid kinked Lines
  - Tighten the fittings according to torque specifications

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Component Harness Installation Recommendations

- Harness installation tips
  - Avoid damage through proper routing
  - Bundle excessive length in protected areas
  - Single wires should be fixed at least every 12 inches
  - Avoid stresses in or bending of Cable/Harness connections
  - Use proper bend radius, do not damage Harness

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Reference Materials for ABS Systems

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On the Back Cover of All Meritor Literature

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Bendix Literature

- www.bendix.com/en
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Summary

During this presentation, you received instruction about:

- ABS system features & benefits
- Identification & Explanation of Operation of ABS & ATC components and the Dash mounted controls & driver Indicators
- Diagnostic procedures of ABS & ATC components and systems
  - Blink Codes
  - Pro-Link 9000 device
  - TOOLBOX® PC Diagnostics
  - Bendix ACom Diagnostics

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Questions and Answers

Click on the hand to ask your question with your voice

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